

**WHAT IS CLAIMED IS:**

1. An apparatus for deep rolling a work piece comprising:  
an upper tool having a housing with at least one work roll and a backup roller positioned therein, said upper tool having an appendage;  
5 a lower tool having a housing with a channel that receives said appendage when said upper and lower tools are positioned about a work piece;  
wherein an engagement of said appendage with said lower tool minimizes relative axial displacement between said upper and lower tools during deep rolling.
- 10 2. The apparatus of claim 1 wherein said appendage is generally L-shaped, and extends substantially laterally from an end of said upper tool.
3. The apparatus of claim 1 wherein said appendage is substantially cylindrical.
- 15 4. The apparatus of claim 1 wherein the position of said appendage relative to said upper tool is adjustable.
5. The apparatus of claim 1 wherein said appendage is metallic.
- 20 6. The apparatus of claim 1 wherein said appendage is non-metallic.
7. The apparatus of claim 1 wherein said appendage comprises an elongate member threadedly engaged with said upper tool.

8. The apparatus of claim 5 wherein said appendage is welded or formed to the upper tool.

5 9. The apparatus of claim 5 wherein said appendage is attached to the upper tool with a fastener.

10. The apparatus of claim 1 wherein said appendage is attached to said upper tool by chemical bonding means.

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11. An apparatus for deep rolling a work piece comprising:  
a first tool having at least one work roll and a back-up roller;  
a second tool having at least one work roll and a back-up roller;  
wherein at least one of said first and second tools is movable to engage said first  
15 and said second tools about substantially opposite sides of a work piece; and

at least one of said first and second tools includes an appendage extending generally toward the opposite tool, said appendage received therein when said first and second tools are engaged with a work piece, thereby maintaining said first and second tools in a substantially coplanar relationship during deep rolling.

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12. The apparatus of claim 11 wherein said first tool comprises two work rolls, and said second tool comprises four work rolls.

13. The apparatus of claim 12 wherein said first tool comprises four work rolls and said second tool comprises four work rolls.

14. The apparatus of claim 11 wherein said first tool comprises a plurality of  
5 appendages.

15. The apparatus of claim 11 wherein said first and second tools each comprise at least one appendage.

10 16. A deep rolling apparatus comprising:  
an upper tool having at least two radially offset work rolls contacting substantially coplanar back up rollers;  
a lower tool having at least two radially offset work rolls contacting substantially coplanar back up rollers;  
15 at least one of said tools being movable relative to the other said tool to engage a work piece there between, wherein said upper and lower tools are adapted to engage a work piece in at least four radial points of contact.

17. An apparatus according to claim 16 wherein:  
20 said upper tool comprises two work rolls supported on each of two back up rollers;  
said lower tool comprises two work rolls supported on each of two back up rollers.

18. An apparatus according to claim 16 wherein at least one of said first and second tools includes an appendage extending generally toward the opposite tool, said appendage received therein when said first and second tools are engaged with a work piece, thereby maintaining said upper and lower tools in a substantially coplanar fashion during deep rolling.

19. A deep rolling apparatus, said apparatus including:  
an upper tool having at least one work roll contacting a back up roller;  
a lower tool having at least one work roll contacting each of two back up rollers;  
wherein said upper and lower tools are adapted to engage a work piece in at least three radial points of contact.

20. The apparatus of claim 19 wherein:  
said upper tool comprises two work rolls supported on said back up roller;  
said lower tool comprises two work rolls supported on each of two back up rollers;  
wherein said upper and lower tools are adapted to engage a work piece in at least six radial points of contact.